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### THE BEETLES OF THE FAMILY CUPEDIDÆ OF AMERICA, NORTH OF MEXICO.

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The members of the family Cupedidæ are undoubtedly among the most remarkable and rare of the Coleoptera known to occur in America, north of Mexico. They are especially remarkable because of their peculiar tuberculate character and the grotesque sculpturing of their bodies. Two taxonomic papers dealing with the American species of the family have been published:

LeConte—"On the Cupesidæ of North America," in Trans. Amer. Entom. Soc., V, 1874, pp. 87-88.

Casey—"Synopsis of the genus *Cupes*" in Ann. N. Y. Acad. Sci., IX, 1897, pp. 637-638.

Five species of the family Cupedidæ have been described from our territory, four of which have been held to be distinct while the fifth, *Cupes oculatus* Casey (13), has been reduced to the rank of a variety by Blatchley (24). After carefully reviewing the facts, however, the writers believe that *oculatus* has good specific characters and it is here considered as a distinct species, the reasons being enumerated hereafter.

Three of the American species have never been figured. This

need the writers have herewith endeavored to supply at the same time including keys and the original descriptions of the genera and species together with some notes on the distribution.

The relationship of the Cupedidæ to the other groups of Coleoptera has long been disputed among systematists and the position of the family is still uncertain.

LeConte and Horn (12) have been followed by most American students, including Blatchley (24), in placing the family in the Serri-cornia. It has remained for Brues and Melander (28) to bring to the attention of the American student the newer and more correct viewpoint of the European Coleopterists in the relationships of groups, and apparently they have followed Ganglbauer (18) more closely.

Sharp (22) has placed the Cupedidæ in the Polymorpha associated with the Cucujidæ but, as Gahan (26) has pointed out, his arrangement of the Coleoptera was evidently not formulated with any particular regard to the phylogeny of the groups.

Doubtless the most comprehensive treatise on the subject has been published by Gahan (26) in which he treats of the results of the studies of Ganglbauer (18), Lameere (14 and 19), and Kolbe (16 and 20), in their attempts to classify the Coleoptera. He shows that the more recent work of these systematists has resulted in the placing of the Cupedidæ, as follows:

Ganglbauer (18) placed the Cupedidæ in the Adephaga, believing them to be a more modified family of that group;

Lameere (19) placed the Cupedidæ in the Cupediformia of the Adephaga, believing them to be Adephaga of the most primitive type;

Kolbe (16) placed the Cupedidæ in the Adephaga, but later (20) removed the family to the Heterophaga or Polyphaga, erecting the division Symphyogastra for their reception.

Gahan (26) does not clearly commit himself as to where he believes the family should be placed, but a careful study of his work shows that he undoubtedly would place the family in the Adephaga and would probably follow Ganglbauer (18) most closely.

Kolbe (Gahan (26), p. 124) has shown that the wing venation of the Cupedidæ is nearer to the original type than all other Coleoptera.

Ganglbauer (18) for this reason, and because the sternites and pleuræ of the second abdominal segment are completely fused with those of the third, considers the group a more modified family of the Adephaga. Gahan (25 and 26, p. 166) gives as an additional reason in support of this disposition of the family that there is a suture on each side of the prothorax between the notum and the pleuræ, a condition met with only in the Adephaga.

Gahan (26, p. 247) has shown that Lameere was mistaken in believing that the second and third abdominal segments are entirely separate which was his reason for considering the family the most primitive of the Adephaga.

Because of the complete fusion of the sternites and pleuræ of the second and third abdominal segments, Kolbe (20) removed the family from the Adephaga and placed it in the Polyphaga but Gahan (25 and 26, p. 166) has shown an additional reason, as stated previously, why this should not be done.

With the description and figuring of the larvæ and pupæ of *Cupes concolor* Westw., Snyder (27), the subject is anything but cleared and Gahan's (26) opinion will perhaps be reversed.

Lameere (Gahan (26), p. 166) believed that the larvæ live in wood and are of the eruciform type. Snyder (27) has shown that the larvæ are of the eruciform type and do live in wood; in fact, they greatly depart from the campodeiform type, and he states that the legs are five-segmented with a single claw, approaching somewhat larvæ of the Lymexilonidæ in appearance. These characters are, indeed, widely different from the campodeiform larvæ with six-segmented legs and tarsi with two claws that are found in the Adephaga, although Gahan has shown here that one exception is now known in Adephagan larvæ in the family Paussidæ which Dr. Böving describes as having only five segments in each leg.

We must, if we are to admit that the two suborders, Adephaga and Polyphaga, are the true major divisions of the Coleoptera, weigh these points very carefully in deciding the position that the Cupedidæ should hold. The characters may be summed up as follows:

## CUPEDIDÆ.

## ADEPHAGA.

Wing venation of the first type (Gahan, 26, p. 124). A suture on each side of the prothorax between the notum and pleuræ (Gahan, 26, p. 166).

## POLYPHAGA.

Sternites and pleuræ of the second abdominal segment completely fused with the third (Gahan, 26, p. 247). Habits of the larvæ. Larvæ eruciform, widely departing from the campodeiform type. Larvæ with legs of five segments—tarsi with a single claw (Snyder, 27).

Shall we, therefore, in view of these characters, consider the Cupedidæ—

1. As a modified family of the Adephaga, as Ganglbauer and Gahan contend?
2. As a distinct subdivision of the Polyphaga, nearly approaching the Adephaga as Kolbe considered them, or
3. As holding a position between the Adephaga and the Polyphaga, having important characters of each of these suborders and indicating a more direct descent from the original Coleopteron? The wing venation would seem to indicate that this might be true.

The writers are more inclined to agree with Kolbe (20) in placing this family in the Polyphaga, for if we are correct in believing that only beetles having the campodeiform type of larva should be placed in the Adephaga, then the Cupedidæ are widely different, notwithstanding the wing venation and the suture on each side of the prothorax between the notum and pleuræ.

To be sure, Dr. Böving's discovery of an exception to the six-segmented leg of the Adephaga in the Paussidæ would tend to show that the Cupedidæ might not be excluded from that group by that reason alone.

If the Coleoptera are really to be arranged with regard to the true phylogeny of groups much and exhaustive study will have to be made on the ontogeny of the species. This knowledge at present is so manifestly inadequate in most families that a grouping in accordance with true racial relationships is usually impossible. Notwithstanding, it is the only permanent basis and the one which should be kept constantly in mind. Therefore, until our information on the

life-history and the bionomics of the species herein concerned is more ample it seems correct to place the Cupedidæ in the Polyphaga, in the position Kolbe has suggested for its retention.

#### IMMATURE STAGES.

Snyder (27) has recently published descriptions and figures of the larvæ and pupæ of *Cupes concolor* and has thereby filled a long felt need.

The larvæ were found excavating longitudinal burrows in solid, but decaying chestnut (telegraph pole) and oak (trestle timbers). The following is Mr. Snyder's characterization of the larvæ and pupæ of *Cupes concolor* Westw.

"The larva is 23.5 mm. in length, white, elongate and subcylindrical. Body gradually broadening from the sixth to the eighth abdominal segment, ninth abdominal segment conical, with numerous long hairs on sides, armed with more heavily chitinized sharp tubercles, being produced to a narrow, heavily chitinized cylindrical anal process; anal process widening at apex, tip concave. Pleural ridge on all abdominal segments. Prothorax prominent, approaching the characteristic dilation of *Eupsalis* and *Lymexilonid* larvæ, broader than head and other thoracic segments. Prosternum broad, flat, armed with numerous chitinized asperities. Legs 5-jointed, excluding claw; first joint large, flattened, fleshy lobe. Labium with hairs on anterior portion. Antennæ 4-jointed. Maxillæ with all three parts distinct; lacinia thick and fleshy, with long hairs pointing inward on anterior portion, palpi 3-jointed; galea 2-jointed. Labium black, chitinous, chisel-edged emarginate, with 2-jointed palpi. Mandible black, chitinous with large, blunt basal tooth and 3 other teeth.

"Pupa is 11.5 mm. in length, white, body somewhat flattened, abdominal segments gradually broadening; anal segment widest, conical; genitalia with 2 lateral, curved, chitinous hooks, pointing anteriorly. Dorsal carina running the whole length of the body, becoming more distinct toward the end of the abdomen. Antennæ lying ventrally, overlapping the clytra. Head bent ventrally at right angles to prothorax. First pair of legs lying between other pairs."

#### CHARACTERIZATION OF THE FAMILY.

Cupesidæ—Lac. (7); LeConte and Horn (12); Blatch. (24).

Cupedidæ—Alluand (15); Peyerimhoff (17 and 21); Gahan (26).

Catalogues—Gem. & Har. (9); Junk (23).

The following characterization is from LeConte and Horn (12) and Blatchley (24).

"Antennæ 11-jointed, filiform, rigid, inserted rather close together upon the front; the head tuberculate, stretched out forward and suddenly constricted behind and attached to the thorax by a distinct neck; thorax small, quadrate, the side margins well defined; prosternum well defined with a slight point behind fitting into the mesosternum; elytra entire, with rows of large punctures and intermediate ribs; front coxæ small, not prominent, their cavities transverse, open behind; mesosternum with the side pieces excavated for the middle legs; hind coxæ transverse, flat, sulcate behind, receiving the thighs in repose; abdomen with five free ventral segments; legs slender, contractile; tibiæ without terminal spurs, tarsi 5-jointed, spongy beneath, their claws simple."

Gahan (26) has shown that the family should be further characterized, as follows:

A suture on each side of the prothorax between notum and the pleuræ; sternites and pleuræ of the second abdominal segment completely fused with the third; wing venation of a more or less completely developed and unmodified state, the costa, subcosta, radius, media, cubitus and analis present and joined together by a greater number of transverse veins than are known to occur elsewhere in the Coleoptera. The anterior branch of the media is a long vein running uninterruptedly almost from the base to the margin and is joined by means of two transverse veins with the media, and by two with the posterior branch of the radius, which, itself, is joined to the radius by two transverse veins. There are, also, two transverse veins between the cubitus and media, and two between the cubitus and analis.

#### KEY TO THE GENERA OF N. A. CUPIDIDÆ.

Antennæ less approximate at base, shorter and stouter, scarcely half as long as the body; eyes small; gular sutures distant, curved slightly outwards; double row of spicula present only on posterior half of elytral margin.

**Priacma** Lec.

Antennæ more approximate at base, longer, less stout, exceeding half length of the body; eyes larger; gular sutures more approximate, not curved outwards, parallel or converging behind; spicula, if present, occupying the full length of the elytral margins.....**Cupes** Fabr.

#### KEY TO THE SPECIES OF CUPES.

The following key is from Casey (13).

Supra-antennal tumid surface rounded and convex; antennæ shorter; tempora more developed behind the eyes, which are usually smaller.

Body black, the head pale and ochreous-yellow in color; punctures of the elytral series very large, deep and quadrate.....**capitatus** Fabr.

Body ochreous, the elytra variegated with confused patches of dark piceous-brown; punctures of the elytral series much smaller.

**lobiceps** Lec.

Supra-antennal tumidity obliquely angulate, the antennæ more elongate; tempora short, the eyes very large; body ochreous in color, the elytra variegated with sublongitudinal patches of a darker brown.

Elytral series composed of large approximate quadrate punctures.

**concolor** Westw.

Elytral series composed of narrow, elongate punctures; antennæ less elongate ..... **oculatus** Casey.

### **Priacma** Lec.

Dr. LeConte (10) characterized this genus as follows:

"Since I have seen the Australian genus *Omma*, I recognize in *Cupes serrata* (Lec. Proc. Acad. Nat. Sc. Phila. 1861, p. 351) a distinct genus, intermediate between that and *Cupes*. From the latter it differs by the antennæ less approximate at base, shorter and stouter, scarcely half as long as the body, with the joints triangular and narrower at the base, the first as long as but stouter than the 3d. The eyes are much smaller, though nearly smooth; the under surface of the head is quite different; gular sutures distant, curved slightly outwards, gular angles not porrected, but broad and truncate; mentum more prominent, maxillæ more exposed, maxillary palpi longer, last joint elongate, cylindrical, truncate. These differences were partly indicated by me in the remarks appended to the description of the species. The color is mottled gray; head with four subacute tubercles, but not lobed, front concave. Prothorax nearly square, with front angles prominent; elytra more convex, alternate interspaces feebly convex and a little uneven; side margins strongly toothed towards the tip."

### **Priacma serrata** Lec. (8).

"Reddish brown, marked irregularly with black variegated with gray and black squamulæ; front concave; thorax transverse with parallel sides, anterior angles acute and divergent, apex towards the middle broadly and slightly projecting, closely punctuated, grooved, anteriorly and posteriorly transversely impressed; elytra cylindrical, serial foveæ quadrate and cancellate, sides towards the apex armed with acute spinulæ in two series; eyes small; antennæ shorter than half the length of the body, ringed with ash and black color. Length .43-.82."



"East of Fort Colville, at Sinyak water depot, and at Camp Kootenay, the variation in size of this remarkable species is very great. Besides the spicula on the lateral margin, and on the extreme inflexed margin of the elytra, a few are visible on the 7th interstitial line near the tip. The blackish markings are scattered along the interstitial line and a broad band behind the middle is also seen."

We were only able to see three specimens of this species in the LeConte collection, from Oregon. Occurs also in Br. Col. and Cal. (Leng.) Lengths 11.-19.5 and 22 mm.

#### **Cupes Fabr.**

Fabr. (1); Lac. (7).

The following is Fabricius' description of the genus.

"Palpi four, equal, last segment thicker, truncate; ligula short, membranaceous, bifid; antennæ cylindrical."

#### **Cupes capitatus Fabr.**

Fabr. (1); Coqueb. (2); Cast. (5); Baynes & Reed (11).

"Mouth with maxillæ and palpi; palpi four, equal, subfiliform, anterior 4-jointed, joints subequal; last thicker, truncate, attached to the back of maxilla; posterior 3-jointed, 2nd joint longer and attached to the base of the ligula; mandibles short, thick, bifid at the apex, outer division slender, filiform, inner broad, rounded; ligula short membranaceous, bifid, with divisions ovate, rounded, distant, antennæ cylindrical. Body elongate, smooth, emarginate, slender, black; head small, ovate, projecting, uneven, red; antennæ much longer than the thorax, approximate, cylindrical, first joint thicker, black, inserted between the eyes; eyes small, globose, prominent, marginal; thorax flat, short, transverse, unequal, black, with margins somewhat projecting, elytra rigid, fornicate, sulcate, ridges black, with raised punctures scabrous, lengthwise of abdomen; legs short, compressed, adapted to running, black; tarsi 4-jointed, reddish."

Specimens examined from "Middle States," "Gulf States," "Central Valley States," Ill., Mo., Md., and Mass. Occurs also in S. C., Va., Tenn. (Leng.) Varies from 7 mm. to 10.5 mm. in length.

#### **Cupes lobiceps Lec. (10).**

"Body elongate, slender, pale-gray, slightly mottled with darker; antennæ compressed serrate for the lower half, two thirds as long as the body; head deeply channelled and transversely impressed, thus dividing into two large posterior tubercles or lobes, and two smaller frontal ones; there is also a lateral lobe behind the eye, separated by a deep groove; eyes large; prothorax



suddenly narrowed in front, with the sides strongly elongated and a large median elevation which has a deep rhomboidal excavation; elytra with rows of moderate sized quadrate punctures, 3d interspace more convex, 5th, 6th and 7th forming an obtuse costa, 2d and 4th flat. Length .45 inch or 11 mm.

"San Diego, Cal. A specimen kindly given to me by Mr. Ulke. This species resembles the figure of *C. latvilliei* Solier (Lacordaire, Gen. Col. Atlas, pl. 47, fig. 2) in the form of the antennæ. It differs conspicuously from our other species by the large posterior lobes of the head and the different sculpture of the prothorax."

Specimens seen from So. California. Occurs also in Ariz. (Leng.) Length from 8 mm. to 9.4 mm.

**Cupes concolor** Westwood.

Westwood (3); Blatchley (24); Snyder (27).

*cinera* Say.

Say (4); Cast. (5).

*trilineata* Melsh.

Melsh. (6).

"Elongate, slender, subdepressed. Pale brownish or ash gray, densely covered with small scales; elytra with darker oblong dashes or blotches, which form three indistinct undulated bands. Antennæ nearly as long as the body. Head with four feebly separated tubercles, with a narrow impressed line between them. Thorax wider than long, about half the width of elytra; disk with a median longitudinal carina and a deep impression each side; side margins abbreviated near the front and hind angles. Elytra with rows of large quadrate punctures; intervals convex, the alternate ones higher. Length 7-11 mm."

Specimens examined from "Middle States," "Central Valley," Indiana, Mass., and N. H. Occurs also in Ga., Fla., Md., Mich., Pa., N. Y. (Leng.)

**Cupes oculatus** Casey.

Casey (13) Blatchley (24).

"Form nearly as in *concolor* but less elongate, pale, yellow-brown, with indefinite sublineate spots of dark brown on the elytra; integuments throughout densely scaly. Head scarcely wider than the prothorax; sides above near the eyes longitudinally tumid, the elevation divided transversely at the anterior limit of the very large convex eyes; median line fine, coarse anteriorly; tempora very short. Prothorax fully  $\frac{3}{4}$  wider than long, rectangular and nearly straight in basal  $\frac{3}{4}$ , becoming feebly convergent and arcuate towards base; disk elevated along the middle, with a fine median line, broadly reflexed at the base, also deeply concave at each side of the middle. Scutellum well devel-

oped, rounded. Elytra  $2\frac{3}{4}$  to nearly 3 times as long as wide, parallel and straight at the sides, gradually narrowed at apex, distinctly wider than the head; ridges feeble, the second and third alone distinct. Under surface densely scaly. Length 8.5 to 9.7 mm. width 2.0 to 2.2 mm." Recorded from Indiana. Occurs also in Md., Kans., Fla., Texas, Mich., and N. Y. (Leng.)

The writers have been unable to see the type of *oculatus*, and it is doubtful if Blatchley (24) had seen a specimen when he considered it a variety. It seems to be quite distinct and as an amplification to the original description the following is quoted from a letter from Col. Casey and a sketch showing the difference in elytral sculpture is included with the figures.

"In *concolor* the body is more elongate and slightly larger than in *oculatus* and the antennæ are longer and more slender. In *oculatus* the head is transversely sulcate between the eyes, there being no vestige of the sulcus in *concolor*: the head and prothorax are very similar in habitus in the two but in *concolor* the sides of the latter are deplanate and not sharply reflexed as they are in *oculatus* and the median ridge of *concolor* is broader.

"The most striking difference is, however, in the sculpture of the elytra. In *concolor* the punctures of the double series are coarser, more close set and quadrate, while in *oculatus* they are elongate, relatively narrower, more distinctly so than shown in the drawing sent herewith, and the series in *concolor* are very much more approximate than in *oculatus*.

"The coloration of the two is nearly alike, being pale ochreous-gray, feebly mottled with darker. In my opinion there is no possibility of these not being two distinct species in the material at hand, the only point being as to whether or not Westwood's species is correctly identified. As my identification coincides completely with that of LeConte, I, however, have no doubt on this score."

Following his description of *Cupes serrata* LeConte (8) added a consideration of the species known at that time, all confined to the genus *Cupes*, in which he pointed out the most important character differences of the species. He said, "It will probably be found on dissection that the characters separating our three species of *Cupes* will warrant them in being considered as belonging to distinct genera." Some time later LeConte (10) did separate the most widely differing species, *serrata*, erecting the genus *Priacma* for its reception.

Four species must still be retained in *Cupes* although certain characters, most noticeably the antennæ, eyes, and tuberculate head, are widely different, but until one finds fresh preserved material for exhaustive study LeConte's conception of the family as indicated heretofore must stand.

The writers wish at this time to thank Mr. Nathan Banks for his kindness in allowing examination and study of the material in the Museum of Comparative Zoology, especially the LeConte collection, which is particularly rich in the Cupedidæ. They desire also to thank Mr. C. W. Johnson for permission to examine the specimens in the collection of the Boston Society of Natural History. To Mr. C. W. Leng and to Col. Casey thanks are also due for notes and suggestions.

Drawings from *Priacma serrata* and *Cupes lobiceps* are from type; *Cupes capitatus* and *Cupes concolor* from typical specimens.

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#### EXPLANATION OF PLATE X.

Fig. 1.—*Cupes lobiceps* Lec., dorsal aspect.

Fig. 2.—*Cupes concolor* Westw., dorsal aspect.

Fig. 3.—*Priacma serrata* Lec., dorsal aspect.

Fig. 4.—*Cupes capitatus* Fabr., dorsal aspect.

Fig. 5.—*Cupes capitatus* Fabr., lateral view of head.

Fig. 6.—*Cupes capitatus* Fabr., ventral aspect.

Fig. 7.—(A) *Cupes concolor* Westw.—Detail of elytral sculpture. (B) *Cupes oculatus* Casey—Detail of elytral sculpture (after sketch by Casey).

### NEW SPECIES OF SERICA (SCARABÆIDÆ). III.

BY R. W. DAWSON,

LINCOLN, NEBRASKA.

*Serica loxia* new species.

♂. Length 7 mm. Color auburn, surface bare, polished and shining.

Clypeus nearly level with the front, feebly impressed below the suture and before the reflexed margins, broadly and feebly tumid just below the middle; anterior margin abruptly, moderately elevated, nearly straight viewed vertically, lateral margins distinctly reflexed, separated from the anterior margin by a sharp, rather deep incisure; punctures moderately strong and closely placed, separated by about half their own diameters; clypeal suture distinct, very obtusely angled at the middle. Front less closely and regularly punctured, the punctures nearly or quite wanting on the occipital area, separated by one half to two times their own diameters on the lower portion of the sclerite. Eyes and antennal club of moderate size. Measurements of head (in tenths of a millimeter) as follows: Diameter of head through eyes, 20; distance between the inner eye margins, 12; length of head on median line, 16; extreme width of clypeus in front of incisure, 9; antennal club, 8; dorso-ventral diameter of eye, 5.

Pronotum relatively broad, short, and flat, the sides nearly straight, and only moderately convergent to the anterior angles; surface rather strongly, closely and evenly punctured, the punctures separated by one to two times their own diameters. Measurements of pronotum as follows: Width through posterior angles, 31; width through anterior angles, 21; length of median line, 17. Scutellum with a few strong punctures, closer toward the sides; length, 6.5; width, 6.5.

Elytra with the usual, moderately well developed striae, each stria with three confused rows of closely placed punctures. Length of elytra, 54; greatest width, 40.